



PATENT
Attorney Docket No. 7363.0010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Reissue Application of:)
U.S. Patent No.: 5,792,261)
Inventor: Kiichi HAMA et al.)
Issued: August 11, 1998) Group Art Unit: 1763
Serial No.: 09/478,370) Examiner: Alejandro Mulero, L.
Filed: January 6, 2000)
For: PLASMA PROCESS)
APPARATUS)

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

APPENDIX TO AMENDMENT

IN THE CLAIMS:

17. (Amended) An apparatus for processing a process region of a substrate, using a plasma, comprising:

a container substantially formed of a conductive material;

a partition plate supported by said container and defining an air-tight process container portion and an air-tight auxiliary container portion, and having a window plate

made of dielectric;

a main exhaust pump for exhausting and setting said process container portion to a vacuum;

a work table arranged in said process container portion and having a support face facing said window plate, the substrate being mountable on said support face with the process region facing said window plate;

a main supply for supplying a process gas between said window plate and the substrate mounted on said support face, at least part of the process gas being transformable into the plasma;

[an antenna] a planar spiral coil for generating an electromagnetic field between said window plate and the substrate mounted on said support face to induce generation of the plasma, arranged in said auxiliary container portion and facing said window plate;

a power supply section for applying a high frequency voltage to said [antenna] planar spiral coil;

an auxiliary exhaust pump for exhausting and setting said auxiliary container portion to a vacuum; and

a pressure controller connected to said auxiliary exhaust pump for keeping a pressure difference between pressures in said process and auxiliary container portions at a minimum value.

20. (Amended) The apparatus according to claim 17, further comprising a cooler for cooling said [antenna] planar spiral coil.

22. (Amended) The apparatus according to claim 21, wherein said inactive gas supplied into said auxiliary container portion is a coolant, by which said [antenna] planar spiral coil is cooled.

23. (Amended) The apparatus according to claim 22, wherein said auxiliary supply comprises a shower head arranged above said antenna and having a plurality of gas supply holes facing said [antenna] planar spiral coil.

24. (Amended) The apparatus according to claim 17, further comprising a seat arranged on said window plate and supporting said [antenna] planar spiral coil.

37. (Amended) An apparatus for processing with a plasma a process region of a substrate, comprising:

a container;

a dielectric window supported by said container and defining a first container portion and a second container portion separated by said dielectric window;

a table for supporting the substrate in said first container portion to face said window;

a first exhaust means connected to said first container portion for drawing a vacuum in said first container portion;

a first supply for supplying a process gas to said first container portion;

[an antenna] a planar spiral coil for generating an electromagnetic field between said window and the substrate supported on said table to induce generation of the

plasma, said [antenna] planar spiral coil being provided in said second container portion proximate said window;

a power supply for supplying a voltage to said antenna;

a second exhaust means connected to said second container portion for drawing a vacuum in said second container portion; and

a second supply for supplying an auxiliary gas to said second container portion; wherein at least one of said first and second exhaust means are controllable to control a pressure differential across said window at a minimum value.

50. (Amended) The apparatus according to claim 37, further comprising a cooler for cooling said [antenna] planar spiral coil.

51. (Amended) The apparatus according to claim 37, wherein said auxiliary gas is a coolant by which said [antenna] planar spiral coil is cooled.

52. (Amended) The apparatus according to claim 37, wherein said second supply comprises a shower head arranged above said [antenna] planar spiral coil and having a plurality of gas supply holes facing said [antenna] planar spiral coil.

53. (Amended) The apparatus according to claim 37, further comprising a seat arranged on said window and supporting said [antenna] planar spiral coil.

64. (Amended) An apparatus for processing a substrate in a plasma, comprising:

a container;

a dielectric window supported by said container and dividing said container into a first container portion and a second container portion;

first vacuum means for creating a first vacuum in said first container portion;

second vacuum means for creating a second vacuum in said second container portion;

a controller for controlling at least one of said first and second vacuum means in order to control a differential pressure across said window at a minimum value;

a table arranged in said first container portion for supporting the substrate;

a first supply for supplying a process gas to said first container portion;

an [antenna] planar spiral coil arranged in said second container portion; and

a voltage supply to said [antenna] planar spiral coil for generating an electromagnetic field whereby generation of the plasma is induced in said first container portion.

73. (Amended) The apparatus according to claim 64, further comprising a cooler for cooling said [antenna] planar spiral coil.

74. (Amended) The apparatus according to claim 65, wherein said inactive gas is a coolant by which said [antenna] planar spiral coil is cooled.

75. (Amended) The apparatus according to claim 65, wherein said second supply comprises a shower head arranged above said [antenna] planar spiral coil and having a plurality of gas supply holes facing said [antenna] planar spiral coil.

76. (Amended) The apparatus according to claim 64, further comprising a seat arranged on said window and supporting said [antenna] planar spiral coil.

85. (Twice Amended) An apparatus for processing a process region of a substrate, using a plasma, comprising:

a container substantially formed of a conductive material;

a partition plate supported by said container and defining an air-tight process container portion and an air-tight auxiliary container portion, and having a window plate made of dielectric;

a work table arranged in said process container portion and having a support face facing said window plate, the substrate being mountable on said support face with the process region facing said window plate;

a main supply for supplying a process gas between said window plate and the substrate mounted on said support face, at least part of the process gas being transformable into the plasma;

[an antenna including] a planar spiral coil having a quadrilateral outer configuration for generating an electromagnetic field between said window plate and the substrate mounted on said support face to induce generation of the plasma, arranged in said auxiliary container portion and facing said window plate;

a power supply section for applying a high frequency voltage to said antenna;
and

a pressure controller controlling a pressure difference between a pressure in said process container portion and a pressure in said auxiliary container portion lower than a predetermined value.

88. (Amended) The apparatus according to claim 85, further comprising a cooler for controlling a temperature of said [antenna] planar spiral coil.

89. (Amended) The apparatus according to claim 85, further comprising a coolant flow passage including a coolant flow for cooling said [antenna] planar spiral coil.

90. (Amended) The apparatus according to claim 85, further comprising a seat arranged on said window plate and supporting said [antenna] planar spiral coil.

100. (Twice Amended) An apparatus for processing with a plasma a process region of a substrate, comprising:

a container;

a dielectric window supported by said container and defining a first container portion and a second container portion separated by said dielectric window, said first container portion and said second container portion each having substantially the same diameter;

a table for supporting the substrate in said first container portion to face said window;

a first supply for supplying a process gas to said first container portion;
[an antenna] a planar spiral coil for generating an electromagnetic field between
said window and the substrate supported on said table to induce generation of the
plasma, said [antenna] planar spiral coil being provided in said second container portion
proximate said window.

a power supply for supplying a voltage to said antenna;
a second supply for supplying an auxiliary gas to said second container portion;
wherein a pressure difference between a pressure in said first container portion
and a pressure in said second container portion is controllable below a predetermined
value to reduce a load caused by the pressure difference on said dielectric window.

106. (Amended) The apparatus according to claim 100, further comprising a
cooler for controlling a temperature of said [antenna] planar spiral coil.

107. (Amended) The apparatus according to claim 100, further comprising a
coolant flow passage including a coolant flow for cooling said [antenna] planar spiral
coil.

108. (Amended) The apparatus according to claim 100, further comprising a
seat arranged on said window and supporting said [antenna] planar spiral coil.

120. (Amended) An apparatus for processing a process region of a substrate,
using a plasma, comprising:

a container substantially formed of a conductive material;

a partition plate supported by said container and defining an air-tight process container portion and an air-tight auxiliary container portion, and having a window plate made of dielectric;

an exhaust pump for exhausting and setting at least one of said container portions to a vacuum;

a work table arranged in said process container portion and having a support face facing said window plate, the substrate being mountable on said support face with the process region facing said window plate;

a main supply for supplying a process gas between said window plate and the substrate mounted on said support face, at least part of the process gas being transformable into the plasma;

[an antenna] a planar spiral coil for generating an electromagnetic field between said window plate and the substrate mounted on said support face to induce generation of the plasma, arranged in said auxiliary container portion and facing said window plate;

a power supply section for applying a high frequency voltage to said [antenna] planar spiral coil; and

a pressure controller connected to said exhaust pump for keeping a pressure difference between pressures in said process and auxiliary container portions at a minimum value.

122. (Amended) The apparatus according to claim 120, further comprising a cooler for cooling said [antenna] planar spiral coil.

124. (Amended) The apparatus according to claim 123, wherein said inactive gas supplied into said auxiliary container portion is a coolant, by which said [antenna] planar spiral coil is cooled.

125. (Amended) The apparatus according to claim 124, wherein said auxiliary supply comprises a shower head arranged above said [antenna] planar spiral coil and having a plurality of gas supply holes facing said [antenna] planar spiral coil.

126. The apparatus according to claim 120, further comprising a seat arranged on said window plate and supporting said [antenna] planar spiral coil.

138. (Amended) An apparatus for processing with a plasma a process region of a substrate, comprising:

a container;

a dielectric window supported by said container and defining a first container portion and a second container portion separated by said dielectric window;

a table for supporting the substrate in said first container portion to face said window;

an exhaust means connected to at least one of said container portions for drawing a vacuum;

a first supply for supplying a process gas to said first container portion;

[an antenna] planar spiral coil for generating an electromagnetic field between said window and the substrate supported on said table to induce generation of the

plasma, said [antenna] planar spiral coil being provided in said second container portion proximate said window;

a power supply for supplying a voltage to said [antenna] planar spiral coil; and
a second supply for supplying an auxiliary gas to said second container portion;
wherein said exhaust means is controllable to control a pressure differential
across said window at a minimum value.

150. (Amended) The apparatus according to claim 138, further comprising a cooler for cooling said [antenna] planar spiral coil.

151. (Amended) The apparatus according to claim 138, wherein said auxiliary gas is a coolant by which said [antenna] planar spiral coil is cooled.

152. (Amended) The apparatus according to claim 138, wherein said second supply comprises a shower head arranged above said [antenna] planar spiral coil and having a plurality of gas supply holes facing said [antenna] planar spiral coil.

153. (Amended) The apparatus according to claim 138, further comprising a seat arranged on said window and supporting said [antenna] planar spiral coil.

LAW OFFICES

FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N.W.
WASHINGTON, DC 20005
202-408-4000